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# Effects of Advertising on the Demand for Potatoes

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# EFFECTIVENESS OF GENERIC AND BRAND ADVERTISING ON FRESH AND PROCESSED POTATO PRODUCTS

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## Abstract

Declining per capita consumption of fresh potatoes prompted potato producers to approve the Potato Research and Promotion Act for generic advertising of fresh potatoes and processed potato products. Generic advertising started in 1971, and annual expenditures currently average $3.4 to $3.6 million. Concurrent with generic advertising is brand advertising on all processed potato products. To estimate returns to potato producers from these advertising expenditures, this paper specified and estimated an econometric model. Results show that both brand and generic advertising are effective in stimulating demand for all processed potato products. Generic advertising does not positively impact the demand for fresh potatoes.

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# EFFECTIVENESS OF GENERIC AND BRAND ADVERTISING ON FRESH AND PROCESSED POTATO PRODUCTS

Two decades of decline in per capita consumption of fresh potatoes have generated widespread concern among potato producers. A decline in per capita consumption from 107 pounds in 1951 to 56 pounds by 1971 prompted the industry to approve the Potato Research and Promotion Act of 1971. The Act specified a mandatory withholding of one cent per hundredweight (cwt) on all potatoes used for food and seed. The check off assessments are intended for advertising, research, market development, and promotion of fresh and processed potatoes. Generic advertising generally accounts for over 75 percent of the expenditures under the Act.

The ultimate objective of potato advertising and other related promotions is to increase potato utilization in domestic and foreign markets. The National Potato Promotion Boards points to the recent accomplishments; yet many producers continue to express concern over the economic gains from the national programs. One indication of producers' concerns is reflected with an increase in refund rates from 11 percent in 1985 to 17 percent in 1986.

Increasing costs and more refund requests contributed to the industry raising producers' check-off fee in 1984 from 1 cent to 2.3 cents per cwt. These additional revenues are intended to expand promotion of both processed and fresh potatoes. Because of the widespread production of potatoes (all 48 contiguous states) and their high economic value ($1.9 billion at the farm-level in 1986), most potato producers are subject to the check-off fee and are beneficiaries of successful potato promotions.

An objective of this paper is to estimate returns to potato producers from generic and brand advertising. Producers are most concerned with returns to their own-supported generic advertising programs. Given the interrelationship between brand and generic advertising, both generic and brand are evaluated. Interproduct relationships between fresh and processed potatoes are considered. A number of simulated impacts from changing generic and brand advertising expenditures are shown.

## ADVERTISING THEORY

Traditional demand theory maintains that advertising is a factor which influences consumer tastes and preferences and ultimately the demand for goods and services (Galbraith, p. 155). New approaches to consumer demand theory (Lancaster; Stigler and Becker) postulate indirect effects of advertising on demand through its effect on the consumer's perception about the commodity characteristics (Nichols, 1985). Since consumers purchase market goods to produce desired characteristics, advertising can influence the 'shadow price' of characteristics and

thereby influence the demand for goods that are used to produce characteristics (Stigler and Becker, p. 84). Thus, if m is a market good and advertising increases the characteristic productivity of m more than the price of m, utility maximizers will purchase and consume more of m (Nichols, p. 217).

While there is some disagreement as to whether the effects of advertising are through an influence on tastes or an influence on characteristic productivity of goods, there is little disagreement that the ultimate objective of advertising is to influence product demand (Nelson; Hoos). It is also recognized that the effects of advertising are not always immediate. Crucial factors leading to lag effects are the type of advertised product and existing attitudes of advertising recipients toward the product (Lavidge and Steiner, pp. 59-60). Lavidge and Steiner specify a series of steps through which people respond to advertising. In the absence of negative attitudes about a product, people develop (1) awareness and knowledge, (2) liking and preference, and (3) conviction and purchase (Lavidge and Steiner, p. 61). When negative attitudes exist, some potential consumers are steps below awareness and therefore an extensive advertising effort may be required to move consumers to final purchases.

Both generic and brand advertising are intended to influence product demand. Brand advertisers may change market shares as well as the total demand while generic advertisers focus totally on market demand. (Connor, et al.) Concurrent brand and generic advertising can be both complementary or competitive (Ward, et al.). Further, recent evidence suggests that consumers' evaluation of generic advertising messages is a function of the products included. For example, consumers gave higher rankings to nutritional messages about potatoes when these messages applied to fresh potatoes alone rather than to both fresh and processed (The Potato Board, p. 2). The competitive nature of generic advertising is reflected in attempts by some Pacific Northwestern states to gain brand identity for their potatoes by stressing regional differences, while the national potato promotion program emphasizes the overall quality.

Advertising is just one of many factors which influence product demand. Income, population, product price, household size and age distribution are among a list of important factors. If advertising is primarily a source of information, it can be instrumental in determining consumers' purchases of experienced goods like food products (Nelson). Advertising is viewed as crucial to survival of firms producing branded products (Connor, et al., p. 232). Moreover, current and growing interest among commodity groups for generic advertising would suggest that these groups also view advertising as a survival strategy[1]. Advertising efforts, whether brand or generic, are expected to

[1]In addition to the more than $350 million annually that is currently being spent on generic promotion, many commodity groups are initiating and/or expanding their promotional efforts.

have positive impacts on sales (Ward, 1988a,b).

While advertising may serve to increase demand for potatoes, it is important to emphasize that there are no supply controls to allow producers to capture the long-run benefits of their advertising efforts. Observations on production for the past two decades show potato acreage remaining reasonably constant and total production increasing at an annual rate of less than two percent, suggesting minimum, if any, response to demand changes. Producers of processed or branded potato products can control their supply and product flow. These marketing attributes provide advertisers of branded potato products with greater capability to realize the long-run benefits of their advertising efforts relative to those marketing fresh potatoes.

## MATHEMATICAL ADVERTISING MODEL

The methodology used to evaluate advertising is an econometric model of the demand and supply forces characterizing the potato industry. A thirteen equation system is specified and estimated with demand equations for fresh, chips, frozen and dehydrated potatoes. The complete model and definition of variables are presented in Table 1. The model uses annual data for the 1970-85 period. Equation 1 reflects the production of potatoes while equations 2-5 reflect demands for fresh and processed forms. Equations 2 through 5 incorporate the current and lag effects of generic and brand advertising. Equations 6 through 13 account for linkages between retail, wholesale, and farm prices. Finally, equations 14 and 15 provide equilibrium conditions. Hypothesized signs are shown to the right of each coefficient in Table 1.

Considerable multicollinearity was present among many of the variables. Principal components were used in several equations to address this problem. By using principal components, these equations could be estimated with no more than three right-hand side variables. Equations without multicollinearity problems, (i.e., Equations 1, 6, 10, 11, 12, 13), could be estimated with the variables as specified. Once the coefficients associated with the principal components are known, then one can work back to estimates for the original parameters. (See Ward and Zahakla for a detailed application of principal components.) The system was estimated using three-stage least squares (Zellner and Theil, p. 388).

As shown in Table 1, generic advertising expenditures (GAE) are not included in the demand for potato chips (Equation 3). This specification results from a lack of generic advertising expenditures for chips during the period of this study. Considerable funds are allocated to potato chip advertising by brand manufacturers, and these are captured with current (AC) and one-year lagged (ACL) chip advertising. Similar specifications capture the

advertising effects for the other processed potato products. All advertising variables, representing the total advertising expenditures on the product for a given year, were deflated by the consumer price index. Current and lagged advertising were not highly correlated for any of the products. Principal components were used in each of the demand equations because of high correlation among other demand factors. Given the large numbered exogenous variables, the first few principal components serve as instruments for the second and third stage estimation.

The justification for the included variables in each demand equation follows from consumer demand theory and previous empirical studies. The unemployment (UN) variable in equation 3, for example, was incorporated as a result of a study conducted by Cardwell and Davis (1980). The authors postulated that chips are a snack food consumed primarily during work breaks. As an alternative snack for chips, chocolate chip (CC) cookies are included to capture substitution effects. A price index representing all snack foods was pretested but proved to be an insignificant explanatory variable. The importance of advertising in each equation was pretested by running regressions which excluded these variables. These pretests showed reasonably constant estimates for the included variables, but a drastic decline in the explanatory power of the equations when the advertising variables were not included.

## EMPIRICAL RESULTS

As shown in equation 2a, of Table 2, generic advertising (GAE) has a statistically insignificant effect on fresh potato consumption (UZF). This is an unexpected result since most generic expenditures have gone toward promotion of fresh potatoes. While generic advertising expenditures on fresh potatoes are statistically insignificant, other demand factors have negative and statistically significant impacts on consumption. As the results show, income (IN), the growth of women in the labor force (WN), and away-from-home food consumption (TF) have adverse impacts on consumption which are statistically more significant than the own price estimate. The insignificant parameter for GAE is probably due to existing attitudes about the commodity and the offsetting impacts of other demand factors.

The nonpositive response of fresh consumption to generic advertising may not suggest a misallocation of expenditures. Much of the decline in consumption of fresh potatoes is believed to be due to the image of potatoes as "fattening and filling, with little or no important dietary nutrients" (McClure, p. 20). Since the promotional programs began, studies have shown that the percentage of consumers who feel the potato has little nutritional value

has fallen from nearly 70 percent to 33 percent. Consumers who feel the potato is fattening have declined from 50 percent to 25 percent (McClure, p. 20). Consistent with the hypothesis of Lavidge and Steiner, these attitudinal changes may be prerequisites for generating positive sales. Inclusion of GAE in the fresh equation assumes a well defined linkage between advertising and fresh consumption. In the complete system, this time linkage may not have been fully specified especially since generic advertising is a relative new addition to the total marketing efforts for potatoes.

Equation 3a shows that brand advertising is effective in stimulating demand for chips. As expected, the current effect (AC) is greater than the one-year lagged effect (ACL). Using these parameter estimates to calculate advertising elasticities at the means (Table 3), the total elasticity indicates a .145 percentage-point increase in chip consumption for each 1 percent increase in chip advertising expenditures. Converting this percentage change in consumption into pounds and evaluating it at the mean price of chips of $0.86 per pound (real dollars) gives a total sales change of $0.021 (Table 4). Assuming producers of potatoes for chipping receive an average of 18 cents from each dollar of sales, then producers' share of the $0.021 sales change amounts to $0.0038[2]. Alternatively, the per capita sales change can be multiplied by the average 1970-85 population to derive annual changes in chip sales resulting from a one percent change in brand advertising. This approach yields chip sales of $4.7 million, with the producers' share amounting to $846,720. Since generic expenditures have been allocated to include chips, there are no estimated returns to producers from generic expenditures.

Both generic and brand advertising are seen to have positive and statistically significant impacts on the consumption of frozen potatoes, primarily frozen french fries (equation 4a). As compared to chips, both the total advertising elasticity of demand for brand advertising and its related long-run per capita sales change are smaller. This differential may appear counter intitutive since the growth in frozen potato consumption has far exceeded that of chips. However, most frozen potatoes are purchased in non-retail markets where direct product advertising is expected to be the least effective. In addition, annual advertising expenditures on frozen potatoes are often less than a fourth of those on chips. Each 1 percent increase in generic advertising is shown to generate a .054 percentage-point increase in per capita consumption of frozen potatoes, smaller than the effect realized from brand advertising. Annual sales of frozen potatoes resulting from a one percent increase in brand advertising amount to $1.4 million versus $1.08 million in gains from generic advertising. Gains in producers' returns are $259,637 and $194,592

[2] USDA reports that producers of potatoes for frozen products receive 18 cents from each dollar of sales of frozen potatoes. It is assumed in this paper that producers of potatoes for chips and dehydrated products also receive 18 cents.

respectively. It should be emphasized that the possible carryover effects of generic advertising was tested in all but the chip equation and it was shown to be statistically insignificant. As compared to brand advertising, this lack of a carryover effect may suggest differences in advertising messages.

Although generic and brand advertising are effective for frozen potatoes, other demand factors are also statistically significant. These other demand factors - income (IN), growth of women in the labor force (WN), and away-from-home food consumption at fast-food establishments (FF) - are more significant than price. The consumption of dehydrated potato products are also positively impacted by generic and brand advertising (equation 5a). As seen in Table 3, the long-run elasticity of brand advertising is smaller for dehydrated potatoes than for chips or frozen potatoes. Processors' current allocation of advertising expenditures may indeed be guided by these relative differences in elasticities. Dehydrated potatoes received less than $2 million for advertising expenditures during 1984 and 1985, as compared to $32 and $34 million respectively for chips, and $8.8 and $12.3 million respectively for frozen potatoes. Relative to frozen potatoes, generic advertising on dehydrated potatoes is seen to be more effective. Again, this could reflect the fact that most frozen potatoes are marketed through institutional establishments where advertising is less effective. A one percent increase in GAE leads to a .07 percentage-point increase in quantity consumed. Generic advertising generated annual sales increases for dehydrated potatoes amounting to $1.55 million, with producers' share totaling $279,720.

While the empirical results are inconclusive regarding the impact of generic advertising of fresh potatoes, it should be emphasized that some selected supermarkets which have worked closely with the advertising programs of the potato industry have reported sale increases up to 40 percent for limited time periods (McClure, p. 22). These local and regional sales, even if sustained for considerable time periods, are probably too little to be reflected in a simultaneous system that measures total changes within the industry. Even with these limited results for the fresh market, the industry seems cognizant of the need for increased advertising efforts, having recently increased the assessment rate from 1 cent to 2.3 cents per hundredweight (Manley and Kenney, p. 9). This increased assessment is expected to boost the 1986 generic promotional budget of the industry to $4.4 million (Brenner, p. 20). These added expenditures coupled with observed attitudinal changes about fresh potatoes could contribute to generic advertising becoming more effective.

## ADVERTISING SIMULATIONS

The reduced form of the model in table 1 is used to forecast changes in potato consumption which result from

changing expenditure levels of brand advertising. Generic advertising expenditures are not simulated because these are endogenous to the model as specified (See equation 14). That is, generic expenditures are tied to the forecasted supplies through a direct per unit assessment. Advertising simulations are performed for the 1985-90 period assuming annual growth rates in brand expenditures of 3 and 6 percent. The 3 percent growth rate represents an extension of historical changes into the future, while the 6 percent growth rate is intended to measure the sensitivity of the model to large increases in expenditures.

The simulations show consumption of frozen potatoes increasing .19 pounds per capita when advertising of frozen products is increased 6 percent annually. In Figure 1 all values are indexed to 1985 as the base, thus reflecting a percentage projected growth relative to 1985. Similarly, a 3 percent rate of growth in advertising expenditures on frozen potatoes lead to consumption changes of .11 pounds per capita. These consumption changes assume all exogenous variables except advertising expenditures to remain constant.

Increased advertising of frozen potatoes, as seen in Figure 1, has little impact on consumption of fresh and dehydrated potatoes, but some initial positive impact on the consumption of chips. A similar relationship is also observed when chip advertising is simulated (Figure 2).

Relative to simulations for frozen potato advertising, simulations for chips and dehydrated advertising show more limited consumption responses. As seen in Figure 2, a 6 percent increase in chip advertising leads to higher consumption of the product throughout the 1985-94 period. Consumption of other potato products is essentially unchanged. Similarly, simulations of advertising expenditures for dehydrated products show an initial but limited response in consumption of dehydrated potatoes, but almost no response in consumption of other products (Figure 3). In per capita terms, dehydrated potato consumption increases annually at rates of .016 pounds and .021 pounds per capita respectively for 3 and 6 percent boosts in advertising expenditures. Chip consumption, by comparison, expands annually at rates of .044 pounds and .057 pounds per capita respectively for similar changes in advertising expenditures.

## SUMMARY AND CONCLUSIONS

Both brand and generic advertising are seen to be quite effective in stimulating demand for all processed potato products. Fresh potatoes, the primary product of emphasis for generic advertising, are not shown to be positively impacted by generic advertising. This non-positive response, however, may simply indicate that generic advertising expenditures may be below the threshold level needed to combat any negative images consumers have

about potatoes. The threshold argument has considerable validity given the observed responses to brand advertising.

As policy makers attempt to assess the intercommodity effects among commodity promotion programs, this model seems to offer some guidelines for assessing these interrelationships. Clearly, commodities which are substitutes in consumption must be evaluated within an integrated framework that captures relevant demand and supply factors. As seen with the simulations of brand advertising for processed potato products, symmetric relationships do not necessarily exist among products. Simulations of advertising expenditures for frozen potatoes have a sizeable impact on chip consumption, but chip expenditures have an imperceptible impact on frozen consumption. This suggests that not all commodity programs are likely to be effective in combating negative impacts resulting from successful promotion of substitute commodities. For example, successful promotion of coke cola which can have a negative impact on milk consumption may or may not be offset by promoting milk. Evaluating such commodities within an integrated framework should provide crucial information for policy decisions.

Given the increased tax assessment on potatoes and the observed attitudinal changes about them, it seems reasonable to expect future brand and generic advertising to be more effective. Of course the success of potato advertising will also depend on advertising efforts for other substitute commodities. Evaluation of the long run effectiveness of potato advertising and possible intercommodity effects among other promotions can be accomplished by extending this model to incorporate other commodities and their advertising efforts. Conceptually such a model may resemble trade models which analyze economic gains and losses resulting from trade.

**Table 1. Econometric model of demand and supply for potatoes[a]**

1. QRP = f(FPFL+, PSL-, TR+, RSL-, QRPL+)
2. UZF = f(RPF-, GAE+: LR+, TF-, IN-, WN-)
3. UZC = f(RPC-: CC+, UN-, IN+, AC+, ACL+)
4. UZR = f(RPR-, RPF+, GAE+: FF+, IN+, WN+, AR+, ARL+)
5. UZD = f(RPD-, RPF+, GAE+: IN+, WN+, AD+, ADL+)
6. RPF = f(FPF+: FPFL+, WR+)
7. RPC = f(WPC+: GP+, TR+)
8. RPR = f(WPR+: RC+, TR+)
9. RPD = f(WPD+: GP+, TR+)
10. WPC = f(FPFL+, GP+, TR+)
11. WPR = f(FPFL+, RC+, TR+)
12. WPD = f(FPFL+, GP+, TR+)
13. FPF = f(QRP-: QRPL-)
14. GAE = .01 UZF + .01 UZC + .01 UZR + .01 UZD
15. QRP = UZF + UZC + UZD + UZO

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Endogenous Variables:

QRP - Total potato production in pounds per capita.
UZF - Utilization of potatoes for fresh consumption in pounds per capita.
UZC - Utilization of potatoes for chips in pounds per capita.
UZR - Utilization of potatoes for frozen products in pounds per capita.
UZD - Utilization of potatoes for dehydrated products in pounds per capita.
RPF - Retail price of fresh potatoes in real dollars (1967) per hundredweight.
RPC - Retail price of chips in real dollars (1967) per hundredweight.
RPR - Retail price of frozen potatoes in real dollars (1967) per hundredweight.
RPD - Retail price of dehydrated potatoes in real dollars (1967) per hundredweight.
GAE - Generic advertising expenditures expressed in 1967 dollars.
WPC - Wholesale price of chips in real dollars (1967) per hundredweight.
WPR - Wholesale price of frozen potatoes in real dollars (1967) per hundredweight.
WPD - Wholesale price of dehydrated potatoes in real dollars (1967) per hundredweight.
FPF - Farm price of potatoes in real dollars (1967) per hundredweight.

Exogenous Variables:

IN - Disposable personal income in real dollars (1967) per capita.
FF - Fast-food expenditures as a percentage of total away-from-home food expenditures.
TF - Total away-from-home food expenditures expressed in 1967 dollars.
WN - Women in the labor force expressed as the percentage of women in total labor force.
UN- Unemployment rate expressed on an annual basis.
AC - Total brand advertising expenditures for potato chips expressed in 1967 dollars.
AD- Total brand advertising expenditures for dehydrated potatoes expressed in 1967 dollars.
AR- Total brand advertising expenditures for frozen potatoes expressed in 1967 dollars.
CC - Retail price of chocolate chip cookies, expressed in 1967 dollars.
LR - Retail price of long grain rice, expressed in 1967 dollars.
WR - Hourly wage rate of industrial workers in real (1967) dollars.
GP - Per gallon price of gasoline in real (1967) dollars.
TR - A trend variable representing the data period with the first value expressed as 70.
RC - Refrigeration costs per 1,000 kilowatt hours.
PSL - Real price of sugar beets per hundredweight, lagged one year.
ACL - A one year lag of AC.
ARL - A one year lag of AR.
ADL - A one year lag of AD.
PRPL - A one year lag of PRP.
FPFL - A one year lag of FPF.

[a]Note that each equation is specified in the form, Y = f(Z[expected sign]: X[expected sign]), where the variables preceding the colon are endogenous and those following the colon are exogenous.

Table 2. EMPIRICAL RESULTS FOR THE FOUR DEMAND EQUATIONS*

(2a) UZF = 103.57 - .63 RPF + .24 LR - .27 GAE - .003 TF - .0048 IN - .675 WN
(4.05) (-.82) (2.79) (-.39) (-4.79) (-3.37) (-3.39)

(3a) UZC = 16.95 - .564 RPC + .044 CC - .044 UN + .0007 IN + .223 AC + .051 ACL
(8.76) (9.40) (8.53) (-2.66) (5.52) (6.29) (1.76)

(4a) UZR = -6.40 - .16 RPR + .26 RPF + 2.06 GAE + .193 FF + .0049 IN + .301 WN + .82 AR + .44 ARL
(-5.09) (-.045) (1.94) (5.87) (8.49) (3.05) (4.36) (6.74) (2.57)

(5a) UZD = -22.02 - .058 RPD + .992 RPF + .971 GAE - .0018 IN - .187 WN + .21 AD + .126 ADL
(2.79) (-3.33) (6.16) (4.42) (-3.75) (-4.16) (2.54) (1.59)

*Only results for these four equations are reported because these are the focus of this paper. Numbers in parentheses are t-ratios.

**Table 3. Brand and Generic Advertising Elasticities**

| Consumption Variable | Advertising Variable | | | | | | |
|---|---|---|---|---|---|---|---|
| | GAE | AC | ACL | AR | ARL | AD | ADL |
| Fresh (UZF) | -.0052 | . | . | . | . | . | . |
| Chips (UZC) | . | .1189 | .0262 | . | . | . | . |
| Frozen (UZR) | .0541 | . | . | .0500 | .0242 | . | . |
| Dehydrated (UZD) | .0712 | . | . | . | . | .0274 | .0171 |

Table 4. Potato Sales and Producers' Returns Implications of Elasticities in Table 2.

| | Consumption Variable | | | |
|---|---|---|---|---|
| | Fresh (UZF) | Chip (UZC) | Frozen (UZR | Dehydrated (UZD) |
| Long-run elasticity of Brand Advertising | . | .1452 | .0742 | .0445 |
| Change in Pounds per Capita (mean change) | . | .0245 | .0287 | .0061 |
| Mean price per pound | . | $.8638 | $.2277 | $.7097 |
| Sales change per capita | . | $.0212 | $.0065 | $.0043 |
| Producer share | . | $.0028 | $.0012 | $.0003 |
| Elasticity of Generic Advertising | -.0052 | . | .054 | .0712 |
| Change in Pounds per Capita (mean change) | -.0027 | . | .0209 | .0098 |
| Mean price per pound | $.0901 | . | $.2277 | $.7097 |
| Sales change per capita | $-.0002 | . | $.0048 | $.0069 |
| Producer share | $-.00006 | . | $.0009 | $.0004 |

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Figure 1. Simulated Sales in Potato Products with Changes in the Advertising of Frozen Potatoes.

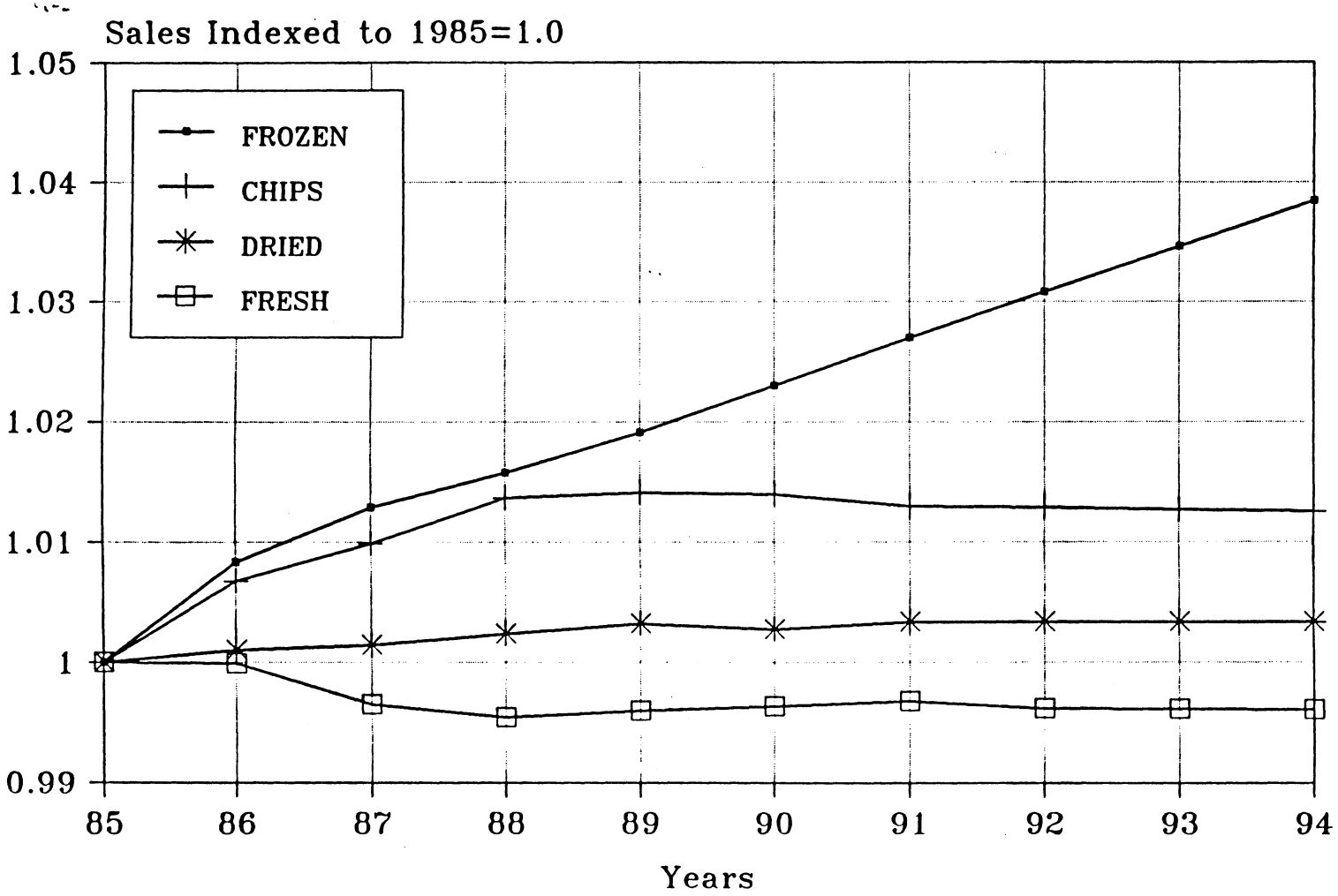

Figure 2. Simulated Sales in Potato Products with Changes in the Advertising of Potato Chips.

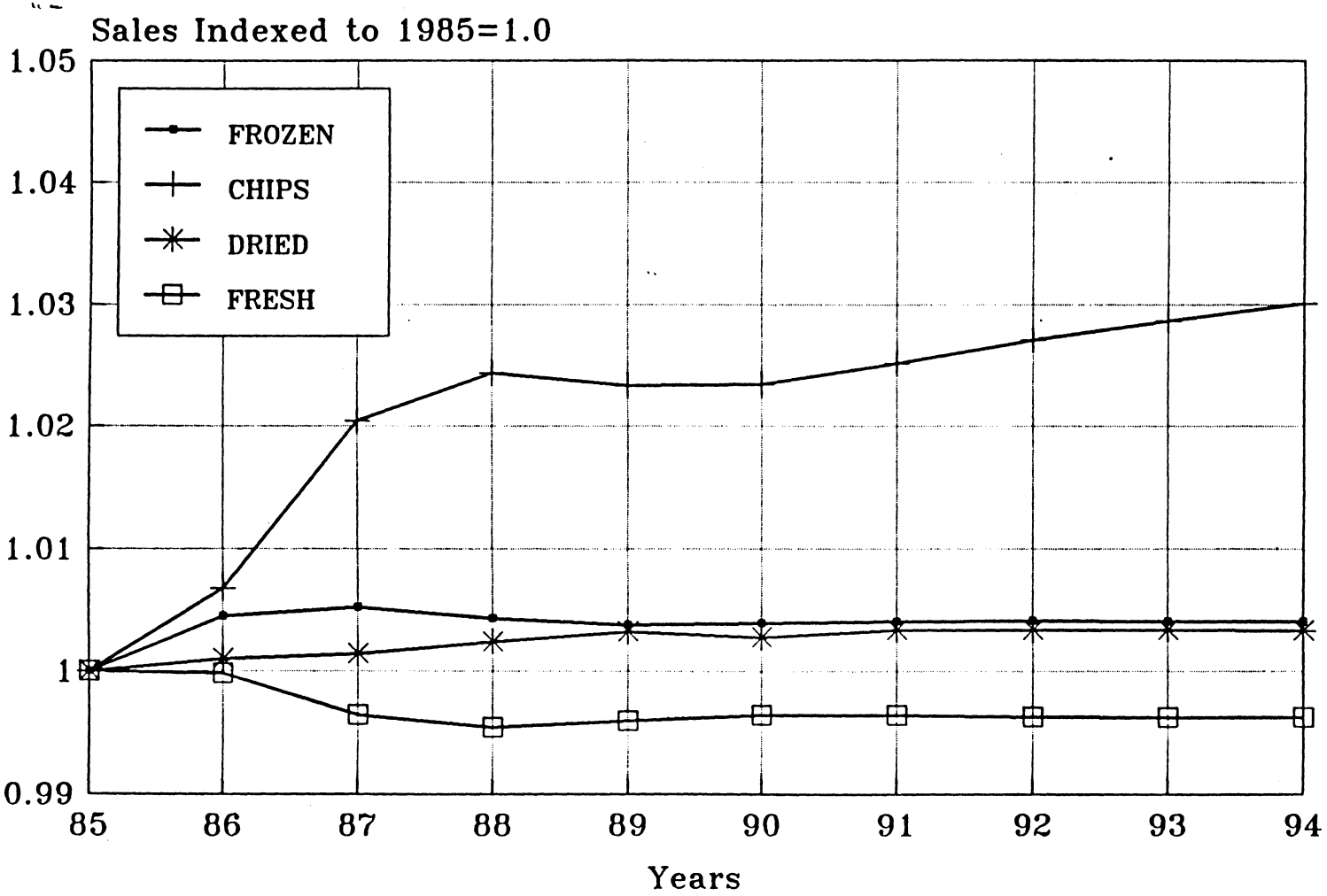

Figure 3. Simulated Sales in Potato Products with Changes in the Advertising of Dried Potato Products.